


```
pip install pgmpy
```

 Collecting pgmpy  
Downloading pgmpy-0.1.25-py3-none-any.whl (2.0 MB)  

2.0/2.0 MB 14.5 MB/s eta 0:00:00

Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from pgmpy) (3.3)

Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from pgmpy) (1.25.2)

Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-packages (from pgmpy) (1.11.4)

Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (from pgmpy) (1.2.2)

Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (from pgmpy) (2.0.3)

Requirement already satisfied: pyparsing in /usr/local/lib/python3.10/dist-packages (from pgmpy) (3.1.2)

Requirement already satisfied: torch in /usr/local/lib/python3.10/dist-packages (from pgmpy) (2.2.1+cu121)

Requirement already satisfied: statsmodels in /usr/local/lib/python3.10/dist-packages (from pgmpy) (0.14.2)

Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from pgmpy) (4.66.4)

Requirement already satisfied: joblib in /usr/local/lib/python3.10/dist-packages (from pgmpy) (1.4.2)

Requirement already satisfied: opt-einsum in /usr/local/lib/python3.10/dist-packages (from pgmpy) (3.3.0)

Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.10/dist-packages (from pandas->pgmpy) (2.8.2)

Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas->pgmpy) (2023.4)

Requirement already satisfied: tzdata>=2022.1 in /usr/local/lib/python3.10/dist-packages (from pandas->pgmpy) (2024.1)

Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn->pgmpy) (3.5)

Requirement already satisfied: patsy>=0.5.6 in /usr/local/lib/python3.10/dist-packages (from statsmodels->pgmpy) (0.5.6)

Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.10/dist-packages (from statsmodels->pgmpy) (24.0)

Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (3.14.0)

Requirement already satisfied: typing-extensions>=4.8.0 in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (4.11.0)

Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (1.12)

Requirement already satisfied: Jinja2 in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (3.1.4)

Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (2023.6.0)

Collecting nvidia-cuda-nvrtc-cu12==12.1.105 (from torch->pgmpy)

Using cached nvidia\_cuda\_nvrtc\_cu12-12.1.105-py3-none-manylinux1\_x86\_64.whl (23.7 MB)

Collecting nvidia-cuda-runtime-cu12==12.1.105 (from torch->pgmpy)

Using cached nvidia\_cuda\_runtime\_cu12-12.1.105-py3-none-manylinux1\_x86\_64.whl (823 kB)

Collecting nvidia-cuda-cupti-cu12==12.1.105 (from torch->pgmpy)

Using cached nvidia\_cuda\_cupti\_cu12-12.1.105-py3-none-manylinux1\_x86\_64.whl (14.1 MB)

Collecting nvidia-cudnn-cu12==8.9.2.26 (from torch->pgmpy)

Using cached nvidia\_cudnn\_cu12-8.9.2.26-py3-none-manylinux1\_x86\_64.whl (731.7 MB)

Collecting nvidia-cublas-cu12==12.1.3.1 (from torch->pgmpy)

Using cached nvidia\_cublas\_cu12-12.1.3.1-py3-none-manylinux1\_x86\_64.whl (410.6 MB)

Collecting nvidia-cufft-cu12==11.0.2.54 (from torch->pgmpy)

Using cached nvidia\_cufft\_cu12-11.0.2.54-py3-none-manylinux1\_x86\_64.whl (121.6 MB)

Collecting nvidia-curand-cu12==10.3.2.106 (from torch->pgmpy)

Using cached nvidia\_curand\_cu12-10.3.2.106-py3-none-manylinux1\_x86\_64.whl (56.5 MB)

Collecting nvidia-cusolver-cu12==11.4.5.107 (from torch->pgmpy)

Using cached nvidia\_cusolver\_cu12-11.4.5.107-py3-none-manylinux1\_x86\_64.whl (124.2 MB)

Collecting nvidia-cuspars-cu12==12.1.0.106 (from torch->pgmpy)

Using cached nvidia\_cuspars-cu12-12.1.0.106-py3-none-manylinux1\_x86\_64.whl (196.0 MB)

Collecting nvidia-nccl-cu12==2.19.3 (from torch->pgmpy)

Using cached nvidia\_nccl\_cu12-2.19.3-py3-none-manylinux1\_x86\_64.whl (166.0 MB)

Collecting nvidia-nvtx-cu12==12.1.105 (from torch->pgmpy)

Using cached nvidia\_nvtx\_cu12-12.1.105-py3-none-manylinux1\_x86\_64.whl (99 kB)

Requirement already satisfied: triton==2.2.0 in /usr/local/lib/python3.10/dist-packages (from torch->pgmpy) (2.2.0)

Collecting nvidia-nvjitlink-cu12 (from nvidia-cusolver-cu12==11.4.5.107->torch->pgmpy)

Using cached nvidia\_nvjitlink\_cu12-12.4.127-py3-none-manylinux2014\_x86\_64.whl (21.1 MB)

Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from patsy>=0.5.6->statsmodels->pgmpy) (1.16.0)

Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from Jinja2->torch->pgmpy) (2.1.5)


Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy->torch->pgmpy) (1.3.0)

Installing collected packages: nvidia-nvtx-cu12, nvidia-nvjitlink-cu12, nvidia-nccl-cu12, nvidia-curand-cu12, nvidia-cufft-cu12, nvidia-cublas-cu12-12.1.3.1, nvidia-cuda-cupti-cu12-12.1.105, nvidia-cuda-nvrtc-cu12-12.1.105, nvidia-cuda-runtime-cu12-12.1.105

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```
import numpy as np
import pandas as pd
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.models import BayesianModel
from pgmpy.inference import VariableElimination
heartDisease = pd.read_csv("heartdisease.csv")
heartDisease = heartDisease.replace('?', np.nan)
print('Sample instances from the dataset are given below')
print(heartDisease.head())
```

 Sample instances from the dataset are given below

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	\
0	52	1	0	125	212	0	1	168	0	1.0	2	
1	53	1	0	140	203	1	0	155	1	3.1	0	
2	70	1	0	145	174	0	1	125	1	2.6	0	
3	61	1	0	148	203	0	1	161	0	0.0	2	
4	62	0	0	138	294	1	1	106	0	1.9	1	

	ca	thal	heartdisease
0	2	3	0
1	0	3	0
2	0	3	0
3	1	3	0
4	3	2	0

```
print('\n Attributes and datatypes')
print(heartDisease.dtypes)
```



```
Attributes and datatypes
age                int64
sex                int64
cp                int64
trestbps           int64
chol               int64
fbs               int64
restecg            int64
thalach            int64
exang              int64
oldpeak            float64
slope              int64
ca                int64
thal               int64
heartdisease       int64
dtype: object
```

```
model = BayesianModel([('age', 'heartdisease'), ('exang', 'heartdisease'), ('cp', 'heartdisease'), ('heartdisease', 'restecg'), ('heartdisease', 'oldpeak')])
print('\n Learning CPD using Maximum likelihood estimators')
model.fit(heartDisease, estimator=MaximumLikelihoodEstimator)
```



```
WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use BayesianNetwork class, BayesianModel will be removed in the future.
Learning CPD using Maximum likelihood estimators
```

```
print('\n Inferencing with Bayesian Network:')
HeartDisease_test_infer = VariableElimination(model)
```



```
Inferencing with Bayesian Network:
```

```
print('\n 1. Probability of HeartDisease given evidence= restecg')
q1 = HeartDisease_test_infer.query(variables=['heartdisease'], evidence={'restecg': 1})
print(q1)
```



```
WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use BayesianNetwork class, BayesianModel will be removed in the future.
WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use BayesianNetwork class, BayesianModel will be removed in the future.
```

```
1. Probability of HeartDisease given evidence= restecg
+-----+-----+
| heartdisease | phi(heartdisease) |
+-----+-----+
| heartdisease(0) | 0.4157 |
+-----+-----+
| heartdisease(1) | 0.5843 |
+-----+-----+
```

```
print('\n 2. Probability of HeartDisease given evidence= cp ')
q2 = HeartDisease_test_infer.query(variables=['heartdisease'], evidence={'cp': 2})
print(q2)
```



```
WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use BayesianNetwork class, BayesianModel will be removed in the future.
WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use BayesianNetwork class, BayesianModel will be removed in the future.
```

```
2. Probability of HeartDisease given evidence= cp
+-----+-----+
| heartdisease | phi(heartdisease) |
+-----+-----+
| heartdisease(0) | 0.3420 |
+-----+-----+
| heartdisease(1) | 0.6580 |
+-----+-----+
```

